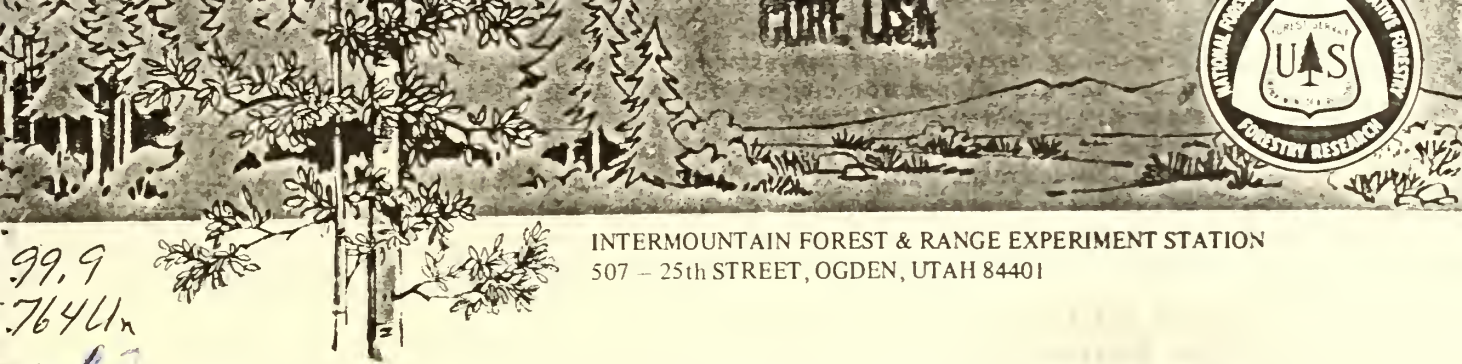


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HABITAT TYPE AND SITE PREPARATION AFFECT SURVIVAL OF  
PLANTED DOUGLAS-FIR IN CENTRAL IDAHO BRUSHFIELDS 220

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ABSTRACT

1 / Survival and growth of Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beisn.) Franco) trees planted under shade on unprepared sites were compared with survival and growth of trees planted in adjacent 8- by 8-foot scalps. Survival and growth were also compared for auger- and bar-planting methods. The scalps increased third-year survival from 18 to 42 percent. Survival was higher for bar-planted trees on scalped plots, but on unscalped plots survival was higher for auger-planted trees. Trees on scalped plots grew 30 percent more than on unscalped plots. The effects of site preparation upon survival and growth appear to differ between habitat types.

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KEYWORDS: Site preparation (artificial regeneration),  
seedling survival, *Pseudotsuga menziesii*,  
shrub competition, habitat types

Poor survival of Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beisn.) Franco) plantings in shrub-covered openings has been a problem in central Idaho. Removal of shrub competition should increase the availability of soil moisture, but it also exposes the site. We have observed that protection of the site against environmental extremes is important for survival and growth of Douglas-fir seedlings on Douglas-fir habitat types.

If we prepare a planting spot by a large (8- by 8-foot) scalp, will the surrounding shrubs provide adequate protection against environmental extremes; or would the trees have a better chance without site preparation? This study was designed to answer this question.

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When the study reported here was established in 1971, a habitat classification system had not been developed for central Idaho. A classification system was available (from preliminary forest habitat typing work by Pfister and others) before third-year measurements were taken; so we identified the habitat type of each plot during that measurement. The dominant habitat type is *Pseudotsuga menziesii*/*Physocarpus malvaceus* (Psme/Phma) with stringers of *Abies lasiocarpa*/*Acer glabrum* (Abla/Aegl) or *Pseudotsuga menziesii*/*Acer glabrum* (Psme/Aegl) in the swales, and *Pseudotsuga menziesii*/*Symphoricarpos oreophilus* (Psme/Syor) on slope crests.

Because the study was not designed to test differences between types, only limited statistical analyses were attempted. However, data summaries indicate strong correlations between habitat type and tree survival. Therefore, the results of seedling survival and growth are presented for habitat types, as well as for site treatments and planting methods.

The principal objective of the study was to compare survival and growth of Douglas-fir trees planted under shade on an unprepared site with survival and growth of trees planted in adjacent openings from which all aboveground vegetation had been removed. Survival and growth were also compared for auger- and bar-planting methods.

#### STUDY SITE

The study area is located within the Boise Basin Experimental Forest in the southwestern portion of the Idaho Batholith. Study plots are on 50 percent slopes in a north-facing basin at an elevation of 6,300 feet. Soils are sandy loams. Dense shrub vegetation covers the area, which was clearcut, but not burned, in 1968.

#### METHODS

Twenty blocks, each containing two 8- by 8-foot plots, were established the first week of June 1971. All blocks were on areas well covered by shrub vegetation ranging in height from approximately 2 to 6 feet. One plot of each block was randomly selected to receive no site preparation. All aboveground vegetation and litter on the adjacent plot was removed with hand tools.

Each plot had two rows with five trees each. The trees were planted 1 foot apart in rows approximately 2 feet apart. On site-prepared plots, this arrangement left a 2-foot buffer strip to plot edge. A 4-inch auger was used in planting one row within each plot; a planting bar was used in planting the other row. Planting stock was 3-0 Douglas-fir from the Lucky Peak Nursery, Boise National Forest. The trees were lifted March 25, 1971, and stored (34° F) at the nursery for 11 weeks, when snowmelt permitted planting. Trees were graded to uniform size at that time. The weather was cool and overcast when the trees were planted, June 9 and 10, 1971. The same two-man crew did all the planting.

Survival was recorded in mid-September of 1971, 1972, and 1973. Annual leader elongation on all surviving trees was measured to the nearest centimeter each time survival was recorded.

#### RESULTS

##### Survival

Third-year survival data show the 8- by 8-foot scalp increased survival from 18 to 42 percent (table 1). The increase was statistically significant at the 99 percent level. Though mean survival was higher (32 percent) for bar planting than auger planting (28 percent), the difference was not significant at the 95 percent level.





Table 1.--Survival of planted Douglas-fir seedlings at the end of the third growing season

Planting method	8- by 8-foot scalp	No scalp	Mean
----- Percent -----			
Auger	36	20	28
Bar	48	17	32
Mean	42	18	

A significant interaction occurred between planting method and site treatment. Survival was higher for bar-planted trees on scalped plots, but on unscalped plots survival was a little higher for auger-planted trees.

The effects of site preparation upon survival appear to differ between habitat types. Nine of our plots were located in the *Psme/Plma*, six in the *Psme/Acgl*, one in the *Psme/Syor*, and four in the *Abla/Acgl* habitat type. Effects were greatest on the *Abla/Acgl* habitat where Douglas-fir is a seral species (fig. 1). A *t* test for paired plots indicated a significant (95 percent level) increase in survival by site preparation on this habitat type, but not on the other three. In fact, no trees survived 3 years on the *Psme/Syor* plot.

#### Height Growth

Trees on scalped sites grew 30 percent more than those on unscalped sites during the 3-year study (fig. 2).

Weighted means show no overall difference between auger and bar planting (table 2). However, data from the table indicate an interaction between planting method and site preparation. There was 35 percent less growth of bar-planted trees on the unprepared sites. A similar interaction in the survival data was found to be significant by the analysis of variance. Too many plots with zero survival prevented an analysis of variance computation for the height growth data; but if we had been able to compute such an analysis, we feel it would have shown a significant interaction exists for the growth data also.

As with survival, the effects of site preparation on height growth appear to differ with habitat type (fig. 2). The (*Abla/Acgl*) habitat had the least growth response to site preparation even though this habitat had the best survival. Growth increase was nearly the same for *Psme/Acgl* (37 percent) and *Psme/Plma* (39 percent) habitat types. However, a *t* test indicated that the growth increases associated with site preparation were not statistically significant at the 95 percent level.





Figure 1.--Survival of planted Douglas-fir seedlings with and without site preparation on four habitat types: *Abies lasiocarpa*/*Acer glabrum* (Abla/Acgl); *Pseudotsuga menziesii*/*Physocarpus malvaceus* (Psme/Phma); *Pseudotsuga menziesii*/*Acer glabrum* (Psme/Acgl); *Pseudotsuga menziesii*/*Symphoricarpos oreophilus* (Psme/Syor).

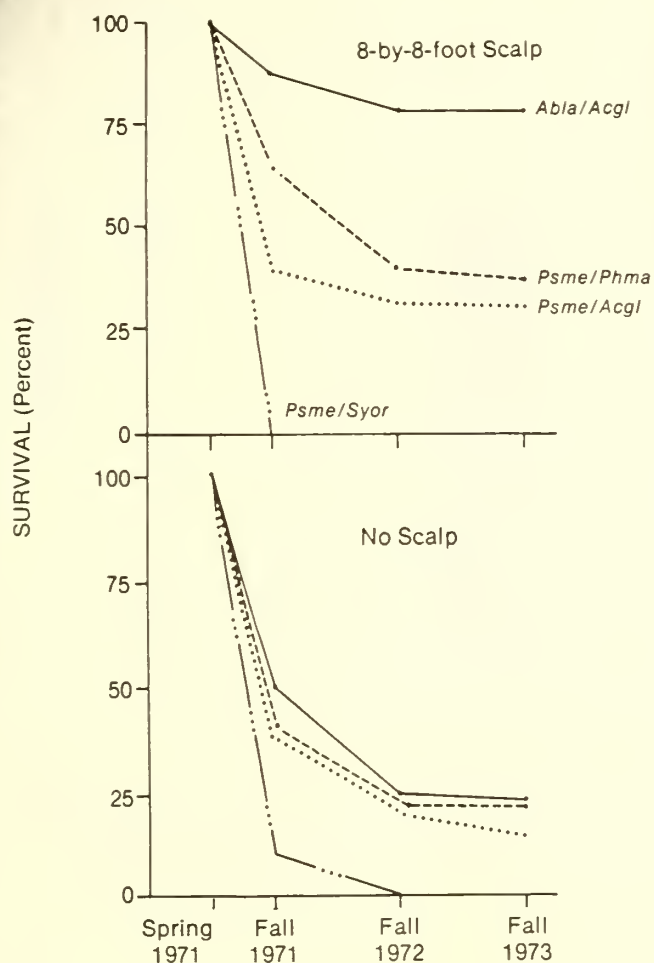


Table 2.--Mean 3-year height growth of surviving trees

Planting method	8- by 8-foot scalp	No scalp	Weighted mean
----- Centimeters -----			
Auger	6.2	6.0	6.1
Bar	6.7	3.9	6.0
Weighted mean	6.5	5.0	



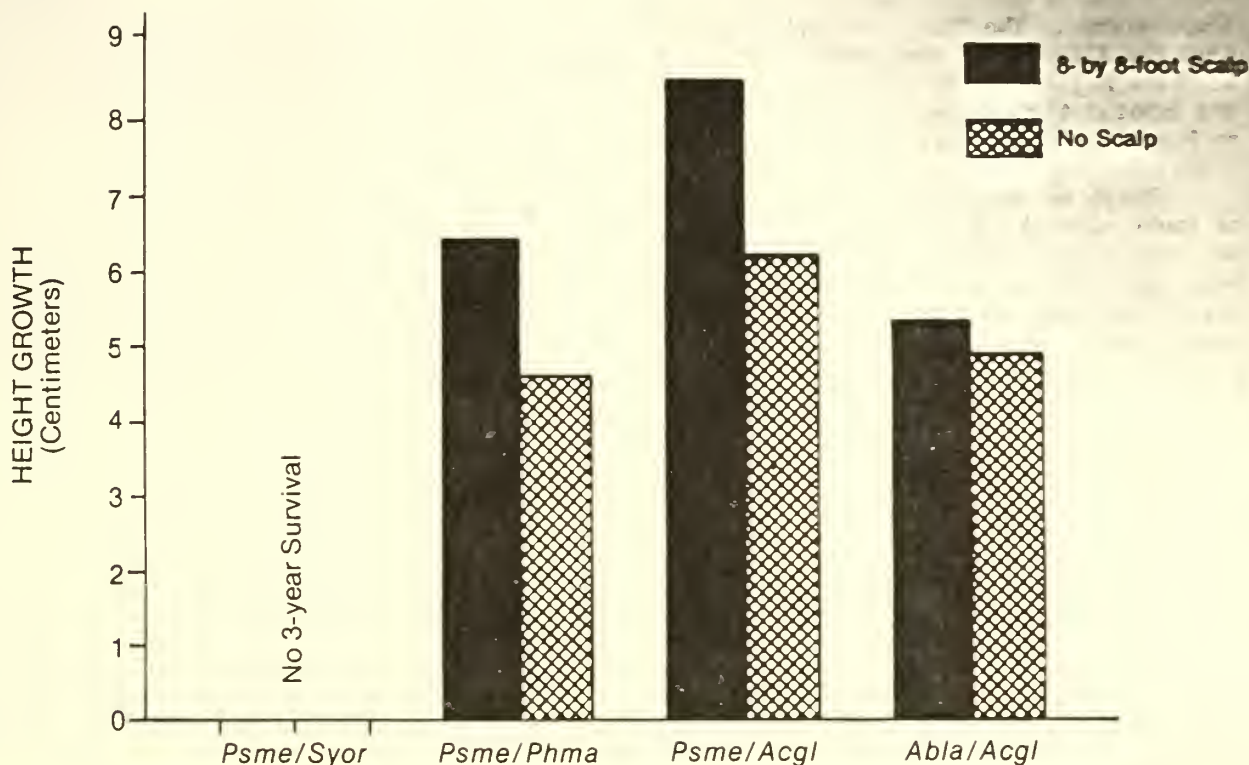


Figure 2.--Mean 3-year height growth by habitat type for trees surviving at the end of the third growing season. Habitat types are *Pseudotsuga menziesii*/*Symphoricarpos oreophilus* (Psme/Syor); *Pseudotsuga menziesii*/*Physocarpus malvaceus* (Psme/Phma); *Pseudotsuga menziesii*/*Acer glabrum* (Psme/Acgl); *Abies lasiocarpa*/*Acer glabrum* (Abia/Acgl).

#### DISCUSSION

As is generally accepted, site preparation increased survival and growth of planted Douglas-fir. However, the degree of response appeared to differ between habitat types.

The interaction between planting method and site preparation is difficult to explain. The poorer performance of bar-planted trees on undisturbed sites might be explained by difference in root competition. A well-planted tree in an auger hole has a world relatively free of competition in which to commence growth--for a short time at least. Bar-planted trees merely have their roots sandwiched between the root masses of competing plants. On prepared sites, competition is effectively removed. However, it is not clear why the bar-planted trees survived better than auger-planted trees on prepared sites.

Of the four habitat types represented in the study, *Abia/Acgl* is the coolest. It is moderately moist and supports a cover of tall shrubs. Douglas-fir is a productive seral species on this habitat type. Removal of competition appears to have increased survival, but the response in growth was quite small, perhaps due to the cooler



temperatures. The *Psme/Phma* and *Psme/Acgl* are also moderately moist sites, but warmer than the *Abla/Acgl*. The greater growth responses to site preparation on the *Psme/Phma* and *Psme/Acgl* might be due to the warmer temperature. The *Psme/Syor* is a relatively dry habitat type occurring only on shallow soils in the study area. These sites appear to have been too severe for tree survival, and were not improved by site preparation.

Though we feel our treatment comparisons in this study are valid, we do not want to imply that the survival and growth obtained represent the best that can be expected on these sites. The quality of planting stock produced by the Lucky Peak Nursery has been improved since this study was made, and storage and handling procedures that better maintain tree quality have been adopted. These improvements coupled with selection of the best-adapted seed source should result in higher survival and greater growth on these habitat types than were obtained in this study.

#### RECOMMENDATIONS

This study reaffirms the need for prepared planting sites to insure success of plantations in Idaho brushfields; even on sites where natural Douglas-fir may become established under a shrub cover.

The degree of response to site preparation appears to vary with habitat type. We recommend that future studies be designed to clarify the effect of habitat types. Then future recommendations can specify the degree of site preparation needed and predict the growth and survival response by habitat type.

